

What is Claimed is:

1. A method for warm up control of an autonomous inverter-driven hydraulic unit, the autonomous inverter-driven hydraulic unit driving a fixed volume hydraulic pump (3) using a motor (11) controlled by an inverter (10), having a heat radiation means (6) provided at a predetermined position of a circulation flow path of an oil which is discharged by the fixed volume hydraulic pump (3), the method comprising the steps of

detecting a temperature of the oil flowing the circulation flow path;  
judging whether or not the detected oil temperature is equal to or less than a predetermined reference temperature; and  
heating-up the heat radiation means in response to the judgment that the oil temperature is equal to or less than the predetermined reference temperature.

2. A method for warm up control of an autonomous inverter-driven hydraulic unit as set forth in claim 1, wherein

the heat radiation means (6) is a radiator (6), and wherein the heating-up the heat radiation means (6) is carried out by controlling a radiator fan (7) so as to lower the heat radiation efficiency of the radiator (6).

3. A method for warm up control of an autonomous inverter-driven hydraulic unit as set forth in claim 1 or claim 2, wherein

the detection of an oil temperature is carried out by estimating an oil temperature from a revolution of the motor (11) when a pressure is controlled.

4. A method for warm up control of an autonomous inverter-driven hydraulic unit as set forth in claim 1 or claim 2, wherein

the detection of an oil temperature is carried out by estimating an oil temperature from a pressure when a flow rate is controlled.

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5. A method for warm up control of an autonomous inverter-driven hydraulic unit as set forth in claim 2, wherein

the controlling of the radiator fan (7) which is carried out for lowering the heat radiation efficiency, is decreasing a revolution of the radiator fan (7) or stopping the radiator fan (7).

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6. A method for warm up control of an autonomous inverter-driven hydraulic unit, the autonomous inverter-driven hydraulic unit being arranged to drive a fixed volume hydraulic pump (34) using an integral-type motor (33) controlled by an inverter (32), the method comprising the steps of

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detecting a temperature of the oil flowing a circulation flow path;

judging whether or not the detected oil temperature is equal to or less than a predetermined reference temperature; and

shifting a current phase from an optimum current phase for increasing heat generation of the motor (33) in response to the judgment result indicating that the oil temperature is equal to or less than the predetermined reference temperature.

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7. A method for warm up control of an autonomous inverter-driven hydraulic

unit as set forth in claim 6, wherein

the motor (33) is a brushless DC motor (33), and the processing for shifting a current phase from an optimum current phase is carried out by shifting a current phase in leading phase side with respect to a speed electromotive force so as to increase a maximum  
5 revolution.

8. An apparatus for warm up control of an autonomous inverter-driven hydraulic unit, the autonomous inverter-driven hydraulic unit driving a fixed volume hydraulic pump (3) using a motor (11) controlled by an inverter (10), having a heat radiation means (6)  
10 provided at a predetermined position of a circulation flow path of an oil which is discharged by the fixed volume hydraulic pump (3), the apparatus comprising:

an oil temperature detection means (15) for detecting a temperature of the oil flowing the circulation flow path;

a judgment means (15) for judging whether or not the detected oil temperature is  
15 equal to or less than a predetermined reference temperature;  
and

a warm up means (16) for heating-up the heat radiation means (6) in response to the judgment by the judgment means (15) that the oil temperature is equal to or less than the predetermined reference temperature.

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9. An apparatus for warm up control of an autonomous inverter-driven hydraulic unit as set forth in claim 8, wherein

the heat radiation means (6) is a radiator (6), wherein the warm up means (16) is a

radiator fan controlling means (16) for controlling a radiator fan (7), and wherein the radiator fan (7) is controlled so as to lower the heat radiation efficiency of the radiator (6) in response to the judgment result obtained by the judgment means (15) indicating that the oil temperature is equal to or less than the predetermined reference temperature.

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10. An apparatus for warm up control of an autonomous inverter-driven hydraulic unit as set forth in claim 8 or claim 9, wherein

the oil temperature detection means (15) carries out the detection of an oil temperature by estimating an oil temperature from a revolution of the motor (11) when a pressure  
10 is controlled.

11. An apparatus for warm up control of an autonomous inverter-driven hydraulic unit as set forth in claim 8 or claim 9, wherein

the oil temperature detection means (15) carries out the detection of an oil  
15 temperature by estimating an oil temperature from a pressure when a flow rate is controlled.

12. An apparatus for warm up control of an autonomous inverter-driven hydraulic unit as set forth in claim 9, wherein

the radiator fan controlling means (16) decreases a revolution of the radiator fan (7)  
20 or stops the radiator fan (7) for lowering the heat radiation efficiency.

13. An apparatus for warm up control of an autonomous inverter-driven hydraulic unit, the autonomous inverter-driven hydraulic unit being arranged to drive a

fixed volume hydraulic pump (34) using an integral-type motor (33) controlled by an inverter (32), the apparatus comprising:

an oil temperature detection means (44) for detecting a temperature of the oil  
5 flowing a circulation flow path;

a judgment means (44) for judging whether or not the detected oil temperature is equal to or less than a predetermined reference temperature; and

a current phase controlling means (39) for shifting a current phase from an optimum current phase for increasing heat generation of the motor (33) in response to the judgment  
10 result of the judgment section indicating that the oil temperature is equal to or less than the predetermined reference temperature.

14. An apparatus for warm up control of an autonomous inverter-driven hydraulic unit as set forth in claim 13, wherein

15 the motor (33) is a brushless DC motor (33), and wherein the current phase controlling means (39) carries out the processing for shifting a current phase from an optimum current phase by shifting a current phase in leading phase side with respect to a speed electromotive force so as to increase a maximum revolution.